

# **Microbial Source Tracking in the San Juan River**

Sources of Impairment: Identifying  
sources impairing water quality

## “Sources”

- Ecological sources. MST sources means different critters: humans, birds, &etc.
- CWA (geographic/location) sources means where a pollutants come from: inadequate WWTPs, CAFOs, &etc.
- Put them together: how could so much human feces get into the river?

# MST overview

- **Objective:** determine sources of bacteria in rivers.
- **Six markers:** humans, cattle, horses, dogs, birds. Two independent bacterial human markers, plus two way-independent (viral) markers to confirm human.
- **High-density data** (temporal and spatial):
  - **MST: Two years** (2013-14), **weekly/bi-weekly**, early April - late October, 3 sites on Animas (more upstream in Colorado) and 2 on San Juan.
  - Concurrent: **nutrients and E. coli** at previously-identified hotspots; April, July, and October of 2014, **43 locations** along Animas in NM. (Average < ½ mile between stations.)
- Lots of other data available (USGS &etc.)
  - Data sharing!

## MST study findings (1 of 2)

- **Impairment:** concentrations and loads of nitrogen, phosphorus, and *E. coli* exceeded WQS and TMDL targets.
- Prevalence of **ruminant and human sources**.
- **NPS:**
  - Geographic source: No single, discrete inflow consistently stands out. Need to address land uses, especially in context of storms.
  - Ecological source: Used MST hits (qualitative) to estimate proportions, applied to *E. coli* (quantitative) to estimate load contributions. Completely removing any one critter very rarely flipped an *E. coli* exceedence to non-exceed.

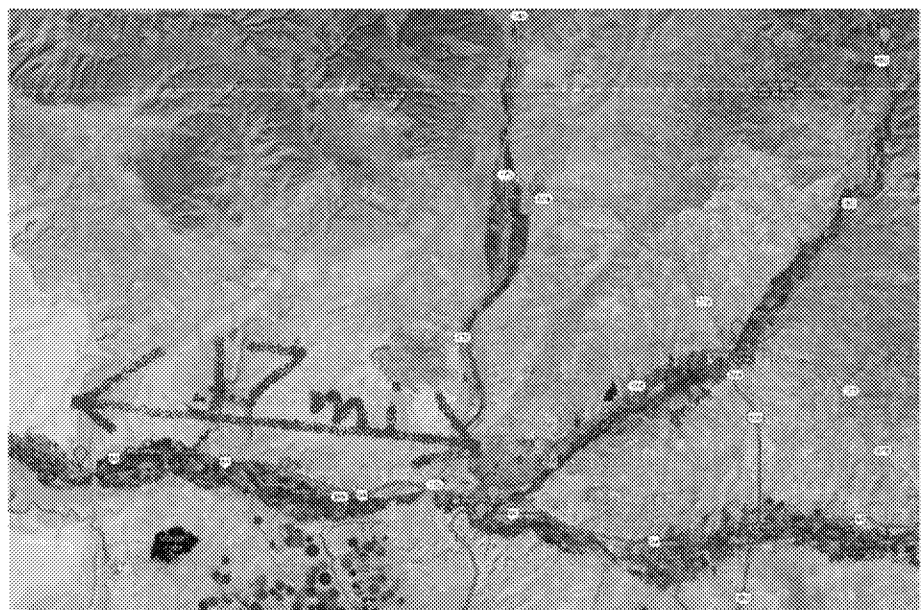
## MST study findings (2 of 2)

- **Doesn't add up:** Nuts and *E. coli* loads at low flow cannot be explained by inflows.
  - Limited data to analyze stormwater inflows (storm-chasers).
- **Data scatter:** concentrations and loads of nutrients and bacteria extremely variable.
  - Stormwater: turb correlates with N, P, and TKN.
  - Seasonal: Above did not increase as much during spring runoff (similar high flows). Channel storage?
  - Flow duration analyses didn't reveal much at all.

# What have we learned since the last watershed plan?

- **Data scatter:** “Hotspot” locations varied greatly from sampling to sampling.
  - Sampled much more frequently than any previous study; better picture of variability over the course of a year.
- **Flow-weighted:** Looking at loads instead of concentrations, the cumulative loads flowing into the Animas were much lower than the load already in the river.
- **Stormwater:** Loads at a single location routinely 100 times higher after storm events than when it hadn’t rained.
- **Channel storage:** Pollutants stored/recycled within the channel remains a data gap, but 1% of storm loads could account for almost all the baseflow load.
- **Smoking guns:** Switched from searching for hotspots to targeting pollutant sources on the landscape, especially ones that reach the river via storm runoff.

Figure 2-1. Site Map with Sampling Locations



Site Name	Latitude	Longitude
A-State Line	37.02450700	-107.87401700
A-Aztec	36.82952300	-107.99707300
A-Boyd Park	36.72075200	-108.20244600
SJ-Farmington	36.70911320	-108.21266484
SJ-Hogback	36.74602246	-108.54849310

# Identifying sources impairing water quality

Didn't exactly accomplish that! (MST data difficult to interpret!) No obvious smoking gun. But support for:

- Illegal dumping – maybe already controlled?
- Septics – subsurface source?
- Bad WWTPs – 402.
- Ag BMPs (lots of flood irrigation).
- Urban runoff (but not a lot of dog).

See WBP for much, much better information!!!



Table 8. Possible sources of human and ruminant bacteria to the Animas River.

Biological Source	Source Activity Pathway to River:	Ground water	Direct Discharge	Irrigation Returns	Storm water
Human	Faulty septic tanks	X			X
	Illegal septic (straight pipes, cess pits, etc.)	X	X	X	X
	Illegal dumping - waste disposal companies		X		X
	Illegal dumping - recreational vehicles		X		X
	Leaking sewer pipes	X	X		
	Wastewater treatment plants		X		
	Outdoor defecation				X
	Ruminant - (includes cattle, deer, elk, sheep, goats)				
	Animals with direct access to river		X		X
	Grazing on irrigated fields			X	X
	Grazing in uplands and riparian areas				X
	Improper manure disposal		X	X	X

# **Review of Implementation Projects in the San Juan Basin in New Mexico**

Current, Ongoing Activities to Mitigate  
Water Quality Impairments:

What activities are already in place?

What is the objective of each activity?

Who is involved?

## Big Picture

- Long time (over a decade), so implementation concurrent with new data collection, which led to moving targets.
- “Musical chair” listings: causes mostly the same, but reaches listed/delisted/relisted. Data scatter!
- SWCD partnership, really stepped up.
  - Especially tech support and coordination.
  - Fiscal agent.
- Very generous BHP-Billiton funding.

# SWQB findings

- Our own intensive surveys, 2002 and 2010
- Impairments (various reaches):
  - temperature
  - coliforms
  - Nutrients
  - DO
  - Benthic Macro Bioassessments
  - Sedimentation/Siltation
  - Sediment Bioassay – Acute.
- Excessive nutrients, visual observations.

# SWQB planning

- **2005? WRAS**
- **2006 TMDLs** for fecal coliform/*E. coli*, sedimentation/siltation, nutrients, dissolved oxygen, and fecal coliform (various reaches).

## Planning (1 of 2)

- **2006**, “A Watershed Planning Approach to Overcome Political Barriers on the Animas River” (\$137,867 EPA 319, \$26,734 state, and \$65,741 local). “Assess, protect and improve water quality in the entire Animas River watershed across the political landscape”. Additional funding from Colorado/EPA Region 10.
  - Resulted in a 2011 WBP, not accepted.
  - Several other projects using funding through Colorado and other sources. Extended water quality study into Colorado.
- **2012?** BHP-Billiton funding (\$500K). MST study &etc.

## Planning (2 of 2)

- **2014**, \$25,456 (604(b)) to SWCD to collect nutrient samples, with MST project.
- **2014**, develop a “Lower Animas Watershed Based Plan” (\$287,540 state, \$189,000 local funds, and \$70,000 local match). Data (including MST) analysis, major planning update.
  - Resulting in the 2014 WBP, EPA-accepted.
- Regional Water Plan.

## Actual implementation (1 of 3)

- **2002**, “Animas River Channel Restoration Project” (\$136,161 EPA 319 plus \$200,000 local in-kind match) to restore geomorphic stability at one site.
- **2005**, “Collaborative Water Quality Improvement Project for the San Juan River Watershed Phase I” (\$264,704 EPA 319, \$181,296 state, and \$94,976 local). Various projects to reduce bacteria and nutrients.
- **2006**, Kiffen Creek demo project. Wetland/channel stability (blown-out sand channel).



## Actual implementation (2 of 3)

- **2007**, SJWG's "Phase II" (\$287,187 EPA 319, \$90,000 other federal, \$30,000 state, and \$176,174 local). Address e. coli and nutrients. Coordination with NRCS (EQIP), sampling to better "understand the variability in water quality over time" &etc.
- **2007?** "La Plata River Riparian Restoration" state funding to SWCD for wetland/floodplain restoration work at the Jackson Lake Wildlife Area.
- **2012?** BHP-Billiton, limited implementation funding, projects not selected.

## Actual implementation (3 of 3)

- **2011**, “Phase III” (\$217,723 EPA plus \$249,200 local), to identify willing landowners and implement BMPs (primarily agricultural).
  - Worked with NRCS to encourage EQIP applicants to add project elements that addressed WQ listings. Selected projects received 319 funding to leverage against EQIP, thus reducing landowner’s cost-share.
- **2015**: \$331,940 state funds to SWCD to replace non-native trees with native vege below Navajo Dam. Over 70 acres along maybe 12 miles of river. Project basically complete.
- Other?
  - Upcoming 319 RFP (now that have accepted WBP ;)
  - SWCD ongoing work.
  - City/county improvements. Riverwalk.
  - Gold King?

# Future?

- Implement Lower Animas WBP
  - Animas not within workshop scope (still not sure why).
- Fill known data gaps (see handout).

# Future on San Juan?

- San Juan planning!
  - Many elements similar to Animas (cut-paste).
  - Much current, relevant data already in hand.
    - MST!
  - “Extend” Animas WBP throughout New Mexico.
    - Including Tribal lands?
  - Extend through Navajo Nation, well downstream of NM?
- “multi-jurisdictional framework” -- a WBP?
  - WBPs can develop/document valid WQ goals.
  - WBP necessary anyway to make valid implementation decisions.